Approaches to JOB MODIFICATION for people who are blind or visually impaired

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Proceedings of
LET'S *NOT* REINVENT THE WHEEL
A National Working Seminar

**Sponsored by Mississippi State University
and the American Foundation for the Blind**

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Proceedings of
LET'S *NOT* REINVENT THE WHEEL
A National Working Seminar on Job Modification
for Blind and Visually Impaired Persons

April 8-10, 1987
Orlando, Florida

AMERICAN FOUNDATION FOR THE BLIND
15 WEST 16th STREET
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Sponsored by **Mississippi State University**
Rehabilitation Research and Training Center
on Blindness and Low Vision
and the
American Foundation for the Blind

American Foundation for the Blind

Approaches to Job Modification for People Who Are Blind or Visually Impaired

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Preface

The April 1987 conference in Orlando, Florida, entitled "Let's *Not* Reinvent the Wheel" focused on an area of concern that has not received attention in past years among professionals who provide services to blind and visually impaired people. The conference took place because of the common interest of Mississippi State University's Rehabilitation Research and Training Center on Blindness and Low Vision and the American Foundation for the Blind in emphasizing the importance of and providing leadership in the areas of rehabilitation engineering, technology, and sensory aids. The purpose of the conference was to generate enthusiasm among public and private, not-for-profit agencies in the blindness field for rehabilitation engineering and job modification services that improve employment opportunities for blind and visually impaired persons.

The 1986 Amendments to the Rehabilitation Act of 1973 provided added impetus to the meetings. The revised statutes provide federal direction for expansion in the nature and scope of services. In the amendments, six references to rehabilitation engineering give additional meaning to the term "comprehensive services." Although the statute presents a guideline, it will be the responsibility of professionals who serve blind individuals to engage in structured planning to meet the challenge of providing high-caliber rehabilitation engineering and technology services. The American Foundation for the Blind and the staff at Mississippi State's Rehabilitation Research and Training Center are well aware of the historical demand for professionals who serve blind persons to be leaders in innovations in rehabilitative services. The genuine excitement of the presenters and participants from 22 states and Canada at the Orlando conference was evidence that professionals working with blind and severely visually impaired persons are taking a leadership position and preparing to meet their challenges.

The sponsoring agencies wish to acknowledge the special contributions that John Brabyn of the Smith-Kettlewell Institute and Robert J. Winn of the Hadley School for the Blind made through their keynote addresses at the conference. We also wish to acknowledge Greg Luther of the Florida Division of Blind Services and Mark Grimes of the South Carolina Commission for the Blind, whose gentle guidance directed us toward organizing the conference. This collection of papers is a tribute to them and to all the other rehabilitation engineers who are serving blind people and who will guide us in the coming years.

John. H. Maxson

Mississippi State, Mississippi
October 1987

Introduction

Diesel mechanic, physical therapist, engineer, attorney, telemarketing salesperson, science technician. These are some of the occupations pursued by people who are visually impaired. These conference proceedings describe the job modifications that have made these employment opportunities a reality.

The significance of "Let's *Not* Reinvent the Wheel," a working seminar on job modification for blind and visually impaired persons that took place in Orlando, Florida, in 1987, is that it provided an opportunity for participants to exchange information and learn about new approaches to job modification and technology. The collection of papers gathered here shares with other professionals in the field the presentations made at that conference.

The success that the blindness system has had in developing the variety of occupations now available to persons with visual impairments can be attributed to both technique and technology. In many cases, it is technology that allows our clients to perform jobs that could not have been performed several years ago. It is, however, technique, the ability to undertake a comprehensive job analysis and job modification procedures, that is critical in job development. Many counselors have expressed the concern that they lack the training and experience to perform these vital procedures. Even with training and information, they question whether they have the aptitude for conducting the type of analyses best done by a rehabilitation engineer. In his conference paper on posing the client's problem to the rehabilitation engineer, William Gerrey provides many client advocates with valuable guidelines for using the engineer's expertise.

All the contributors are to be commended for developing techniques that have the potential for broad utilization. I would also like to thank them for the work they did in preparing their presentations. Unfortunately, these proceedings do not include some of the informal concerns expressed at the conference. Some of the concerns and suggestions that developed out of group discussions were the following:

- The need to meet the job requirements of multiply handicapped people.
- The need to develop a resource directory of rehabilitation engineers.
- The need to provide low technology solutions, particularly for older persons.
- The need to increase the use of rehabilitation engineers.
- The need to provide the field with up-to-date information on technology resources.
- The need to upgrade the system for evaluating equipment.
- The need to solve the problem of how to fund expensive technology.

The concern for persons with multiple disabilities is appropriate. The conference papers by Sue Story and Renee Tennant focus on this area, both in general and specific terms. More work, however, needs to be done.

The American Foundation for the Blind (AFB) recognizes its responsibility to address many of these issues. AFB's Job Index and User Network provide a great deal of information on the variety of jobs performed by persons with visual impairments, information on job accommodation, job modification, and the use of technology. AFB's National Technology Center also provides information on evaluating technology, and this material is helpful in making choices about appropriate equipment. Staff at AFB are also working on projects that will increase the use of rehabilitation engineers, improve the funding of expensive technology, and deal with the needs of multiply handicapped individuals. Readers are encouraged to contact AFB for further information, as well as for identifying additional concerns.

One final note: I wish to express appreciation to John Maxson and the staff of Mississippi State University for the tremendous amount of work they did in developing and facilitating the Orlando conference. Their cooperative attitud and professional commitment made this joint project a positiv and valuable experience.

Gerald Mille

New York, New York
December 1987

List of Contributors

Duane R. Christianson, Manager, Electronic Sensory Aids Training Program, Chicago Lighthouse for the Blind, Chicago, Illinois

Deborah Churchill, Coordinator for Visually Impaired Students, St. Mary's Campus of the College of St. Catherine, Minneapolis, Minnesota

Beverley E. Conrod, Clinical Psychologist, Department of Psychology, Concordia University, Montreal, Canada

William Gerrey, Rehabilitation Engineer, Smith-Kettlewell Eye Research Foundation, San Francisco, California

Wesley Hayes, Instructor, Alabama Institute for Deaf and Blind, Talladega, Alabama

Robert M. Lambert, Associate Professor, Department of Psychology, Concordia University, Montreal, Canada

Lynn W. McBroom, Research Technician, Rehabilitation Research and Training Center on Blindness and Low Vision, Mississippi State University, Mississippi State

Robert McGillivray, Director, Low Vision Services, Carroll Center for the Blind, Newton, Massachusetts

John H. Maxson, Director of Training, Mississippi State University, Mississippi State

Billy Mayfield, Supervisor of Instructional Services, Addie McBryde Rehabilitation Center for the Blind, Jackson, Mississippi

Gerald Miller, Director, National Services in Rehabilitation and Employment, American Foundation for the Blind, New York, New York

Sam Rogers, Placement Specialist, State Services for the Blind and Visually Impaired, Arizona Industries for the Blind, Tucson, Arizona

George A. Saiki, Coordinator, Services to the Deaf and Blind, Division of Vocational Rehabilitation, North Dakota Department of Human Services, Bismarck, North Dakota

Jay Stiteley, Sensory Aids Specialist, Rehabilitation Research and Training Center on Blindness and Low Vision, Mississippi State University, Mississippi State

Sue M. Story, Blind Rehabilitation Specialist–Research, Southeastern Blind Rehabilitation Center, Veterans Administration Medical Center, Birmingham, Alabama

Renee Tennant, Project Specialist, Office of Supported Employment, Division of Vocational Rehabilitation, Madison, Wisconsin

Laurel A. Tucker, Vision Rehabilitation Specialist, Pennsylvania College of Optometry, Philadelphia, Pennsylvania

Faith Weathington, Coordinator of Evaluation/Case Management, Alabama Institute for Deaf and Blind, Talladega, Alabama

Robert J. Winn, President, Hadley School for the Blind, Winnetka, Illinois

Part I

CLIENTS AND PROFESSIONALS: PRIMARY CONCERNS

Posing the Problem to the Rehabilitation Engineer

William Gerrey

In the pure form of the discipline, engineering is a design procedure. In their university training, the classic engineering students learn skills for designing things to address well-defined problems that are posed to them. Only as they expand their careers do they get involved with fundamental definitions of problems. In engineering school, we were always counseled that an engineer's life span in industry is about 10 years; he or she would then be shifted into a responsible position. In industry, channeling efforts toward appropriate engineering—making sure a problem is properly defined—is a team management skill.

This is of direct concern to those who employ engineers as consultants in solving problems that arise in adapting jobs for visually impaired individuals. Except for those emerging from new programs where "rehabilitation engineering" is taught, the traditional engineering discipline does not overlap that of the client advocate. For the client advocate—the rehabilitation counselor, the vocational specialist, or a company personnel officer—posing the problem is in itself a problem. I hope that my experience as a rehabilitation engineer can lead to suggestions and guidelines that will help in this process.

The solution lies in dialogue between the client advocate or caseworker and the engineer and can be summarized by the following points, which the rest of this paper will discuss:

- Even if it seems like overstating the case, the client advocate should give as much detail as he or she can find out about the job problem.
- The advocate must demand feedback from the engineering consultant: "From what I've told you, what do you make of the situation?" (If the engineer has learned anything in school, it is how to report to people; his or her answer should be plausible and have face validity.)
- The advocate should call other engineering resources for second and third opinions and should not be afraid to share points from other conversations with these new consultants.

DESCRIBING THE PROBLEM

The client advocate must describe the entire job to the engineering consultant, not just the advocate's perception of the difficulty. Too often, the visual technique for doing a job is all that the engineer hears. For example, the advocate might improperly pose the problem: "The employee will have to be able to identify colors; can this be done?" Usually, colors are merely visual indicators of conditions that go beyond the issue of color itself. The experienced rehabilitation engineer will ask what the colors mean. If colors are used to identify materials, what kinds of pieces and what types of materials are used? Are they color-coded labels or colored wires? When you buy wooden dowels in a hardware store, the ends of various sizes are dipped in colored paint to identify them. Does this mean that a blind client could not sort dowels? No, but it does mean that the blind worker will have to have a quick way of assessing their sizes, perhaps some type of sizing jig.

In 1975, I was asked by a famous vocational specialist, "Is there a color identifier yet?" I answered, "No, what do you want it for?" It turned out that the job was electronic assembly. The vocational specialist was lucky indeed that I was a blind person working in electronics. If I had taken that request at face value, I would have launched a major development project before its time (before computer analysis), and the client's problem would not have been solved in a reasonable period. As it happened, I had the solution quickly at hand. The assembly problem was one of installing diodes into citizens band (CB) radios with correct orientation. Diodes have their color identifiers placed at their cathode ends. These colored identifiers indicate not only orientation, but also the part number of the diode. For the job, the part number of the diode was a given; identifying the colors so as to read this number was not a problem. Because diodes have distinct electrical properties that can be assessed electrically (they conduct electricity in only one direction), a piece of model railroad track was set up with a tester; by just dropping the diode on the track, the worker could tell its orientation. In contrast to this simple solution, a "color identifier" would have done too much—it would have read the part number, either backward or forward, which would have taken too long. The key was that I knew more about the problem than the need to identify color.

In a similar case, a rehabilitation counselor told me of a job that was passed up for a blind person because the worker would have had to sort pieces of tubing of different materials, all apparently the same size. Whereas sighted workers were doing this by the color of the materials, the blind person could have done so by, for example, weight, magnetic properties, or sound (by tapping on them).

Counselors or client advocates may think they are being specific when they are not. Telling the engineer that "there is a pressure gauge to be read" is something, but not enough. What kind of pressure guage is it? A braille tire gauge is already available. Does the worker actually have to read the gauge, or just know when a danger point has been reached? Is the fluid (gas or liquid) too caustic or too prone to contamination for an audible gauge to be substituted? Reading the visual gauge might be necessary, but it is often more time-consuming and less accurate than using a substitute instrument.

In two separate instances, I was asked to develop special gauges for use in quality control of machined parts. Parts were to be "measured" to ensure that they were within fine tolerances. I had already developed an audible micrometer system for a blind machinist, and a talking "height gauge" was just emerging from the laboratories of the American Foundation for the Blind, but both these devices would have been expensive. As it turned out, in both cases the parts were to be subjected to the so-called "go, no-go" test; if they were too thick or too thin, they were thrown out. Instrumentation for providing this test is much simpler. In one instance, off-the-shelf "snap gauges" were used (precision, clamplike devices that could be permanently set to given dimensions). In the other case, a commercial dial indicator that had "go, no-go" presettable limits was connected to a two-tone oscillator system. A good part would not activate either tone. Knowing that measurements were to be taken and that precision was essential was not enough information. Outlining the job in an exact way saved me from doing too much and led to efficient instruments.

To summarize, the client advocate should tell the engineer everything possible that he or she knows about the job. In addition, the advocate should always be prepared to act as a liaison between the rehabilitation engineer and the technical people at the job site.

MONITORING THE ENGINEER

The counselor or client advocate should not let embarrassment get in the way of questioning the engineering consultant. In fact, by having to answer naive-sounding questions, the engineer can be forced to clarify the proposed design, first in lay terms and then to himself or herself. Engineering is a complicated profession, and it often helps the engineer to be asked to confront his or her own logic—to ask, "How would that solve my client's problem?" When a lot of money is involved or when an answer does not appear to be simple and direct (and it will not be if the problem is complex), the proposed solution should be noted down, and other opinions should be sought.

Monitoring and assessing the engineer's proposal is absolutely essential. The field of engineering is replete with subcategories and areas of specialization. Within electronics, for example, the engineer's favorite paradigm might be software and hardware (digital or analog), with favorite topics being communications and instrumentation. Solutions to problems will differ from consultant to consultant, depending on the engineer's favorite paradigm. In some instances, complex software or machinery has been introduced that could have been avoided. When graphics are involved, a talking computer may not be appropriate. When gauge readings are changing or adjustments are being made, talking gauges are slow and unresponsive; variable frequency tones or alarm sounds might be better. The point is, before development is launched in a particular direction, the counselor or advocate should find out what the engineer is proposing to do and check it with other resources.

KNOWING YOUR RESOURCES

Especially for counselors and client advocates, knowing whom to call, and not being afraid to do so, is the shortcut to having the same technical expertise as the consultant. Have at your elbow catalogs of devices and lists of telephone numbers to call. The major outlets of small devices have engineering departments that can be consulted. For example, Science Products can be reached on a direct line at (215) 296-2114. Likewise, the National Technology Center at the American Foundation for the Blind can be reached at (212) 620-2080. Designers of software cannot hope to isolate themselves from inquiries either. In addition, although they do not market anything, research organizations and service agencies are available for obtaining opinions and suggestions. Examples of these would be the Bureau for the Blind of Kentucky and the vocational specialists at the Sensory Aids Foundation.

Although, as noted, engineers all have their paradigms and opinions, this small field of "devices for the blind" leads us to be fair and professional about each other's work. Unlike the mainstream commercial world, where companies doing similar work are in hot competition, we in this small sphere are more secure in our uniqueness, and we have learned to expect inquiries about each other's work.

CONCLUSION

There is an inevitable mismatch between the rehabilitation engineer (whether a garage inventor or a master of science) and the person placing blind people in positions of work and education. The solution is dialogue—the more exchange, the better. The rehabilitation engineer has a task: knowing what *not* to build (a thing already in a catalog) is so important that the topic became the title of this conference ("Let's *Not* Reinvent the Wheel"). But to know what *is* needed, the burden rests on the person with blind clients. He or she would pile on detail as if talking to a police detective and should be prepared to find a shop foreman or other technical people on the job site with whom the engineer can be involved.

Although I hold a bachelor's degree in engineering, I strongly feel that demanding credentials of consultants is not an answer. This would have the undesired effect of eliminating some of our best engineers. For example, some of the best access programs for computers have been written by users, not computer scientists. In the field of electronics, some of the most brilliant inventions were meters designed by a blind high school teacher, Robert Gunderson. T. V. Cranmer, a landmark inventor of our time, now holds an honorary doctorate from the University of Louisville. When I congratulated him, he quipped, "I may be the only person with a seventh-grade education ever to get an honorary doctorate in applied science." The actual solution is that we must know good work when we see it.

The Hyper-Worker Paradox: Psychological Hazards of Job Modification

Robert M. Lambert and Beverley E. Conrod

For years, radio and television advertisements have implored employers to hire disabled individuals, proclaiming that they are not only able to work but exhibit superior commitment to their jobs. The continuing need to promote employment of visually impaired people makes us hope that these ads are successful. Yet their very truth may be a source of some concern.

PSYCHOLOGICAL HAZARDS

Most people probably experience some anxiety about their ability to maintain and advance in their jobs. At reasonable levels, this anxiety undoubtedly contributes to the self-discipline that is so important in ensuring reliability at work. However, the "superior" commitment of visually impaired employees to their work may reflect a heightened sense of job insecurity and a concomitantly unhealthy level of anxiety. Associated with this insecurity are chronic doubts and frustrations about underemployment, substandard pay, and impediments to promotion and feelings of intimidation in negotiating for advancement, vacation time, scheduling, and the like.

Although modifications of the work site obviously play a major role in making employment feasible for many visually impaired individuals, at least two conditions often attending such modifications might have further adverse psychological effects on visually impaired workers. These conditions occur, first, when modifications involve organizational or permanent physical changes at the work site itself, and, second, when the modifications involve tools or equipment that the worker cannot use in a discretionary manner. Examples of these conditions include the provision of assistive personnel and installation of special switchboards or other machinery, as well as the use of VersaBraille Optacon or microcomputer equipment that is neither owned by the worker nor available for his or her long-term discretionary use. Such conditions increase workers' dependence on either the employer or the rehabilitation agency mediating their job placements. Although workers placed under these conditions will almost surely feel gratified initially by the chance to be productively employed, there are potential psychological hazards in the long run. The already stressful anxiety about job security could be dangerously increased. Job-related frustration and resentment may arise and then produce secondary feelings of guilt. There is an increased risk of illness related to job stress. There is also an increased risk of derived compromises to other areas of the worker's overall adjustment to visual impairment.

COUNTERMEASURES

There are four ways in which a visually impaired worker's rehabilitation environment can reduce the severity of these psychological hazards. First, rehabilitation counselors must be particularly sensitive to these risks. The pressure on the counselor to maintain placements must be laid aside in favor of the stresses placed on the client by the job. Second rehabilitation counselors can be alert to the help that may be provided by psychologically trained professionals in cases of job-related stress. The emotions associated with a visually impaired worker's desire to succeed and fear of failing may be very complex and worthy of in-depth therapeutic assistance Third, rehabilitation counselors and agencies should develop worker-centered strategies and materials for job performance Visually impaired workers who bring skills and tools with them to the workplace are less likely to feel insecure or frustrated than workers who depend on conditions in the workplace to make their work possible. Finally, the rehabilitation establishment must press for the enlargement of programs that give visually impaired employees either ownership or proprietary discretion over the tools of their trades. Rehabilitation and autonomy are, after all, essentially synonymous. Visually impaired workers who have control over the means of their work will feel more like their visually unimpaired counterparts in the work force. We believe that this sense of "normalcy" is more than an illusion. It may well make a significant contribution to the visually impaired worker's sense of competence and thus to his or her sense of self-esteem and general well-being.

We fully recognize that the important goal of self-sufficiency in employment for visually impaired individuals requires both jobs and workers capable of adaptation. We are not critical of cooperative arrangements among agencies, workers, and employers that simply provide visually impaired workers with jobs. Our purpose here is merely to remind ourselves that psychological hazards may exist when jobs are modified for the workers, rather than the workers prepared for jobs.

Part II

GENERAL PRINCIPLES AND APPLICATIONS

Speech Access for the IBM PC: Supplemental Materials Developed by the Hadley School for the Blind

Robert J. Winn

For the first year and a half after the introduction of the IBM PC, virtually no access systems existed that allowed visually impaired individuals to use commercial software with this computer. During this time, one could only connect a speech synthesizer or braille display for utilization as a printer. "Print Screen" or printing a file from a word processor to the speech synthesizer or braille display might allow the user to get the information, but not in a controlled or efficient manner.

The next advance in access systems was a variety of speech output and large print systems with improved screen review capabilities but limited interactive control features. These new systems allowed the visually impaired user to perform a wide variety of tasks using commercial software, but still not always efficiently. These systems were not always totally transparent to the commercial software either.

Over the past two years, vast improvement has been made in these systems. Many more features have been added, they have become more transparent to the commercial software, and they are more easily controlled by the user, more adaptable, and easier to use. No longer must the visually impaired user remember two completely separate command structures (one for the commercial software and one for the access system). Now many access systems allow the adjustment of their command structure to be integrated more fully into the command structure of the commercial software being used. A wide variety of choices, a high degree of efficiency, and more control are now available to the visually impaired user of the IBM PC.

Following is a brief description of some of the most important features to be included in a speech access system for visually impaired computer users, along with some explanation of why each feature is necessary. Of course, not all these features are necessary to perform every task. For example, if the user is only going to write programs, an access system with fewer features might be adequate. However, since many of us do a variety of tasks throughout a given day's work, it is important that there be access systems that are adaptable to a wide variety of environments.

This discussion will be limited to speech systems designed to give access to commercial software. Custom software brings up very different issues and deserves separate consideration.

SPEECH ACCESS SYSTEM CONTROL

Having good control over the access system is critical to the user's efficiency and satisfaction. It is necessary for the system either to provide its own speech synthesis or function fully with a wide variety of available synthesizers. The system should allow the user control over the rate of speech, the pitch of the voice, and the volume. The user should be able to quiet the speech either temporarily (until the next interaction) or more permanently (until specifically requested).

A dictionary that allows the user to store a definition of how the synthesizer pronounces given words or phrases is important for many applications. This dictionary should allow control characters to be entered so that meaningful words can be substituted for them.

It is important that the access system offer the user choices such as the following:

Line numbers spoken or ignored
Numbers spoken as digits or as words
Uppercase indicated or ignored
Punctuation spoken or ignored
Punctuation pauses inserted or ignored
Unusual letter combinations spoken or spelled
Repeated characters spoken, counted, or ignored
Spaces between words indicated or ignored

Unusual formats identified or ignored
Highlighting, blinking, underlining, or color identified or ignored

KEYBOARD TOGGLES AND OTHER FEEDBACK

Depending on the task being performed, the user may want echoing of each keystroke, after each word, or not at all. Efficiency, familiarity of the user with the keyboard, and the need for accuracy at the time of input are the factors determining which option the user would choose.

The IBM keyboard has toggle keys that control important functions. These keys include "Caps Lock," "Num Lock," "Scroll Lock," and "Insert" (which for some software toggles with the "typeover" mode). Auditory feedback about the status of these keys reduces the chance for error.

CURSOR ORIENTATION

Commands for identifying the exact character, word, or entire text of the line on which the cursor resides are essential for any speech system. Commands for reading from the beginning of the line to the current cursor position and from the cursor position to the end of the line make orientation to the cursor easier. To maintain relative screen orientation, the user may want an easy way to ascertain the current line and column number of the cursor position. For applications in which there are delays, it is necessary for the visually impaired user to have feedback as to when the cursor is at rest and input will be accepted.

NAVIGATION

It is easy to understand why getting accessible feedback about cursor navigation is important, but perhaps some explanation of the complexities of this is warranted. Ideally, instant feedback should be given as the cursor is moved forward or back a character or word; up or down a line; forward, back, up, or down columns; to the top or bottom of the screen; to the beginning or end of text; and so on. At times, however, the visually impaired user may want to explore the data without dragging the computer cursor along. To meet the needs of both exploration and input, the user must have control of the computer cursor as well as an independent reading cursor, or announcer.

The same navigation features are needed for both. If the screen exploration takes the announcer very far from the computer cursor, it is awkward and time-consuming to find out the location of each and perform the math and manipulation to bring them back together. Therefore, it is most efficient to have built-in commands to join one with the other. For this joining process to be successful, a variety of speeds is necessary. Some commercial software requires a slower pace for success than others.

WINDOWS

For the purpose of speech access systems, windows are defined as a specific area of the screen on which the software displays important messages, columns of text, status lines, help menus, or any other information to which the user refers frequently. Since today's software often utilizes this type o screen display, it is necessary to have a method for identifying these windows to the access system. There must also be commands for moving into and out of these windows. If these windows display messages that are constantly changing (such as column position of the cursor in a word processor or a clock in a terminal program), there must be a method for turning off the constant chatter these messages would invoke. It is important to have the window feature for reading down o across columns, since there are times when the columns may have several words across or the screen may display two o more sets of columns. It is also very practical, however, to have the option of reading only the word on which the cursor lands when reading up and down by line. This feature would give a quick, albeit rough, way to read straightforward columns without having to set window boundaries first.

ACCESS SYSTEM SEARCH

Although the "Search" command of the commercial software is useful to the visually impaired user, it is not adequate. This command is usually document oriented and operates far beyond the boundaries of the current screen. Frequently, the visually impaired user wants to look for information with the assurance of remaining within the boundaries of the current screen. Thus, the access system's search function should be restricted to this area. It should allow searching of highlighting, underlining, and color changes, since this information is important for the user of today's spelling checkers and other programs. The search feature should have the "wild card" capability, because the visually impaired user may not always know exactly how the given text is displayed.

PLACEMARKERS

In settings such as customer service departments or insurance companies, where the visually impaired employee may be required to fill out forms on the computer, placemarkers are extremely valuable. They provide a quick way to find specific information on the form without having to read it through. Several different forms may be used frequently, so that as many as 99 or more placemarkers could be useful.

FORMS

When working with databases and other forms applications, the visually impaired user must be able to maneuver quickly around the unprotected fields, while getting the information from the related protected fields. A speech access system should have functions that allow this to happen. Commands for reading the two different fields separately should be included.

GRAPHICS

At the present time, a speech access system can do little to assist the visually impaired user with graphic materials. One system on the market can store a given graphic example with a user-provided description. Each time that exact graphic appears, the computer will speak the prestored description.

COMMAND INTERRUPT

For the sake of efficiency, it is important to be able to interrupt any access system command. This is necessary, for example, if the user has given the command to read the entire screen and then discovers the information needed was in the first few lines. Similarly, when skimming information by line, it is not always necessary to hear the entire line. This interruption should be accomplished by the issuance of another command rather than an additional command of its own.

COMMAND PASSTHROUGH

Access systems that use the computer keyboard for the entry of their commands intercept the entry first. Only if the entry is meaningless to the system does it pass this command directly on to the applications program. In some cases, it is necessary to force a command to be passed directly to the applications program without being interpreted or acted on by the access system. This feature is important if there is a command conflict between the applications program and the access system. Most systems have eliminated many conflicts of this nature by allowing at least two different ways to issue any command given outside the protected review mode. Others have protected most of their commands in the review mode and rely on user-definable macros for efficient issuance. Still others have a separate keypad through which all the system commands are issued. This latter solution eliminates any command conflicts nicely, but it requires the user to remove his or her hands from the computer keyboard each time a system command is needed.

MACROS

The capability of creating and storing a variety of macros to perform common functions is even more crucial for the visually impaired user than it is for other users. Since the visually impaired user must use many commands to do the "looking" for him or her, it is important to make this process as efficient as possible.

STORING

Once all these features of the access system have been set, it is essential that the capability be available to store them permanently. Many users need to store several configurations to meet the needs of different software programs and environments. Storage also allows users to find the most successful settings for a variety of popular software and share them with others, saving the new user both time and frustration.

DOCUMENTATION

All documentation for the access system should be available on disk so that the user has access to it immediately on receiving the program. This is not usually sufficient, however, since the documentation is not accessible while the program is actually running. Therefore, the documentation should be available in at least one other accessible medium, such as audio tape, braille, or large print. It is desirable that the print copy be readable by an optical character recognition (OCR) machine. All documentation should be well divided and labeled for easy location of specific information.

CONCLUSION

Since the goal of access software is to make access to commercially available software not only possible but productive for the visually impaired employee, student, or personal user, it is essential that these access systems offer the built-in features, the capacity for user-definable macros, and the alternative command structures needed by these users. Much progress has recently been made in this direction. However, as commercial software changes and new ways of displaying and manipulating data are used, access systems will have to change too. Only through open communication between the user and the developer can this process continue successfully.

Braille Computer Access: Supplemental Materials

Robert J. Winn

Braille is not an appropriate access medium for many blind computer users, because of the late age of onset of blindness for some, inadequate training for others, and poor tactile sensitivity in still others. A method of accessing the computer using speech is usually the alternative. It requires no tactile skills and less training than braille, it is less expensive, and, in most cases, it is faster.

In many instances, however, braille is appropriate, either as the sole access medium or in tandem with speech. Obviously, this may be the only choice for a computer user who is severely hearing impaired or deaf-blind. Braille is likely to be the medium of choice for computer users who must listen to other input, for example, customer service representatives, telephone salespeople, or medical, legal, or other transcribers using a Dictaphone. Few people can concentrate on two voice inputs at the same time. In situations such as accounting or programming, where accuracy is critical, the user's medium of preference should be high on the list of considerations. Some blind users simply cannot pick out the minute details with speech that they can with braille.

There are two ways of gaining access to a computer using braille. One is with a braille embosser. This is much like an ink printer, except that the output is in braille. The other is with electronic or refreshable braille display devices. These devices have the capability of storing the same data that go to the computer screen and displaying these data on a 20- to 40-cell braille display window through which the user can read them.

BRAILLE EMBOSSERS

There are a wide variety of braille embossers on the market today, with the most commonly used ones ranging in price from about $2,800 to $16,000. As one might expect, they offer a range of features. The potential user should determine the importance of each of these features, given the setting in which the embosser is to be used.

Speed, noise levels, and maintenance are the first factors to consider. The rate of embossing ranges from 10 to 130 characters per second. The price goes up accordingly, with the $2,800 to $3,500 embosser producing from 10 to 20 characters per second, the $5,000 embosser producing 35 characters per second, and the $16,000 embosser producing 120 to 130 characters per second. All embossers are quite noisy, but this too varies. The range is from 60 to 85 decibels. Furthermore, only the most expensive embossers are built to run eight hours a day, day after day. Most will not stand up to this stress. Consequently, good maintenance and, if necessary, replacement agreements are important to look for when purchasing an embosser.

The quality of the braille is an important consideration. Although most embossers produce good braille on the regular 100-weight braille paper, some allow for adjustment of impact to permit good brailling on various weights of paper. Many blind computer users may want to use the lighter paper for producing rough drafts or short-term documents. Braille paper is not only expensive, but hard to get. There is at least one embosser available that will produce both braille and dot matrix print either separately or on the same page. This is important in some settings where both are needed. However, its braille is not as sharp as that of the other embossers. Therefore, if the primary need is for braille output, this is not the best choice.

Flexibility in braille codes is also important. For example, all embossers will produce computer braille that gives a one-to-one character representation but has no way of distinguishing between upper- and lowercase. This would be useful in programming, where case is not important, or in accounting, where it is more important to keep exact format. Most have a built-in Grade 1 braille translator that adds an uppercase indicator before a capitalized letter. Of course, this throws off exact format representation, but it is necessary to a word processor. All embossers will produce the contracted Grade 2 braille, but very few have built-in translators. The user will have to purchase a separate translation program to run on the specific computer being used. Some embossers will produce graphics, but none of them have built-in programs for this. There are several Grade 2 braille translators for various computers on the market, but there are few graphics programs, and they are designed for educational purposes and run only on the Apple computer.

Brailling complicated formats is difficult with any braille device. Embossers normally allow only 40 to 42 characters per line (only half the width of most computer screens and less than two-thirds of a regular printed line of a document). At least one company is working on a program allowing a line of up to 80 columns to be printed across two pages. This would be useful, although somewhat awkward, when an exact representation of the computer screen or printed layout is necessary.

Ease of interfacing with the specific computer is also important. It is easy to connect a braille embosser to the printer port of virtually any computer and print out a file, but interacting with the computer is a bit more difficult. Some embossers can also be terminals. That is, they have a braille or typewriterlike keyboard for inputting into the computer. To use an embosser efficiently as a terminal, some communications software must be present. Some embosser/terminals have user-selectable, preprogrammed setups for a variety of computers. Others have only limited communications parameters built into the unit and require a terminal program to be present in the computer instead.

Normally, embossers are used only as output devices to produce hard-copy documents. The input and manipulation of data are usually accomplished more efficiently by using some other computer access system. Occasionally, however, there are environments in which the braille embosser/terminal is appropriate.

REFRESHABLE BRAILLE DISPLAYS

When choosing a paperless braille device, one must decide whether a less expensive screen access device (in the $3,000 to $4,000 range) is needed, or whether a more expensive ($5,000 to $7,000) multipurpose unit would be preferred. Besides giving the blind user varying degrees of access to the computer screen, some paperless braille devices are quite functional as "stand alone" devices. That is, they serve a valuable function even when not connected to a computer. They have their own keyboard; internal memory; usually a tape or disk drive or drives; communication ports for printers, modems, or other peripherals; and editing features. Therefore, they can be used in the classroom, in the office, or on the road to take notes; to produce a letter, memo, or other document; or to send or receive electronic mail messages or other information.

Before buying a paperless braille device, the potential user would have to evaluate separately each of these features for its quality and its value to him or her. Here we will be concerned with those features that are necessary to provide efficient access to the computer screen. Whether the user has a single- or multipurpose device, if he or she is serious about computer access, a good-quality braille display and efficient access features are important.

A screen access unit is connected to the computer, monitoring the data as they go to the computer screen. A "picture" of the data is stored in the memory of the paperless braille device. This picture is updated each time the computer screen is updated. By using directional control buttons or a joystick, the user can move the refreshable braille display window reading the data anywhere on the screen. As with any access device, controllability is one of the most important considerations.

Some devices have their own keyboard for inputting data into the computer. Others are simply output devices requiring the use of the computer's keyboard for input. If the braille display is being monitored frequently, as with data bases or spreadsheet programs, it may be more efficient to use a unit that has its own keyboard. This would keep the user's hands nearer the display and require less movement to return to the keyboard.

If format is important, the user will want to have displayed all data, including large blind areas. The data must be displayed exactly as they appear on the computer screen, even if this means words will be split between the 20-cell display window. There must also be a warning signal at the beginning of a new line. If format is not important, the data are much easier to read if large blank areas are ignored, words are not split between display windows, and line changes are no longer important. For this reason, it is valuable to have a choice between the functions "display formatted data" and "display unformatted data."

Easy movement of the display window is required. Depending on the application and screen format, the ability to make the following movements with the braille window is important:

To the right or left one full display
Straight up or down
To the beginning or end of the current line
To the top left of screen (home)
One cell to the right or left (for centering a column of data)
To the beginning or end of text
Up a given number of lines (for reading long commands)
To a user-definable area of the screen (for quick review
    of error messages, menus, or status line)
To the computer cursor

Because the user is seeing the data on the screen through a very limited window, it is important to have some quick and automatic search capabilities as well as orientation functions. They would include the following:

Search for a given string of text on the screen
Set and find at least 10 different placemarkers
Display line and column number of first braille cell of the current window
Display line and column number of the current computer cursor position
Set tabs for reading across columns

The device should be able to perform certain special functions. For example, on a computer screen, a single character might be upper- or lowercase. It could also be displayed with attributes such as blinking, underlining, flashing, or inverse video. However, because there are only six dots in a single braille cell, there are a limited number of characters that can be created. In order to maintain exact relationship of one character on the braille display to one character on the computer screen, it is important to have some way of distinguishing between the many different attributes of a single character. Therefore, the following special functions are necessary:

Vibrate or flash uppercase characters
Issue audible warning when attributes change
Indicate specific attributes in some tactile or audible way
Search for each of the above attributes

A choice of options for cursor display is useful. When interacting with the computer, the braille display window will usually follow the cursor. Depending on the task, one may want the cursor to be displayed at the right, in the middle, or at the left of the display. For example, one may want the cursor to the far right of the display when entering new text into word processor or at the command level on the compute Here it is important to see as much of the text or comman before the cursor as possible. However, if one is editing document, it may be preferable to have the cursor displaye in the middle of the display so that a word or two before an after the cursor can be immediately read. There should b options for "display cursor right," "display cursor middle," an "display cursor left."

The refreshable braille displays are quiet and virtuall instantaneous in their response, and they are designed to wor well in environments where they are used continuously fo long periods of time. However, a good maintenance an replacement agreement is important to look for, since the use is highly dependent on that device for access to the compute

CONCLUSION

The two means of braille computer access—braille embosser and refreshable braille displays—are not competitive with on another. Most of the time they are used in different setting for different types of tasks. In some situations, however, bot may be important to getting a job done.

Moreover, these devices are not appropriate for ever blind user of computers. Many blind users access computer quite well using just speech and an inkprint printer. Onl through careful evaluation of the user's skills and preferences a thorough understanding of the demands of the task to b performed, and knowledge of the strengths and limitation of the different devices can one make a successful match

Adapting the Work Environment for Supported Employees with Sensory Impairments

Renee Tennant

Employment for individuals with severe disabilities has expanded to include a new realm of opportunities for integration and paid employment in community businesses. Supported employment moves beyond readiness barriers to employment by offering placement, training, and other long-term support services needed by individuals to get and retain jobs.

The community offers individuals with severe disabilities an array of meaningful options for employment, allowing them to be matched to jobs that complement their unique strengths and preferences. Case studies of supported employees demonstrate success with those individuals considered hardest to place because of the severity of their disabilities—people with multiple disabilities, including sensory impairments. The keys to success include job matching, adaptations, and long-term support services.

The success of supported employment placements is not completely contingent on the employee's ability to perform but relies on the expertise of service providers in developing options that offer a balance between achieving the individual's employment goals and accommodating the needs of businesses providing employment. In making the needs of individuals with severe disabilities a priority, service providers need to investigate the knowledge, skills, and abilities that contribute to successful placement. The complete process for supported employment placement includes a community-based functional assessment, job development, job matching, job training, advocacy with employers and co-workers, and ongoing support. In placing individuals with multiple disabilities, the provider's ability to match jobs and individuals creatively and develop adaptations contributes to effective placements.

The preliminary processes of individual assessment and job matching lay the groundwork for ensuring effective placement. In assessing clients for supported employment, the service provider must develop an understanding of the whole individual in order to make an appropriate job match. For this reason, supported employment assessments are conducted in natural, community environments where the evaluator can observe the individual's ability to function in the context of familiar activities and focus on various factors that relate to the work setting. These factors include communication, orientation and mobility, social interaction skills, level of independence in task completion, and nature and intensity of assistance needed. Other considerations include previous work history, the client's preferences, and input from significant others. Once these factors are considered, a picture of the individual's options for employment becomes apparent.

The information collected during the client assessment, combined with information gathered in specific work environments, determines suitable job matches for individuals. Once an appropriate work environment is determined, job training begins. During this training phase, ideas for job adaptations begin to evolve. The use of adaptive devices serves to enhance the employee's level of participation and independence in completing work tasks.

ADAPTING WORK ENVIRONMENTS

York and Rainforth (1986, pp. 4-9) outline a process for adapting work environments for individuals with multiple disabilities. This process can be considered the foundation for adapting environments to the spectrum of individuals served in supported employment. The description that follows summarizes the steps in that process.

Select an Environment for Placement

Selecting an appropriate work environment is the first step in the process. For our purposes, this is accomplished during the job matching phase, as previously discussed. In considering appropriate placements for individuals with sensory impairments, it is important to choose work tasks that make sense in terms of tactile considerations and capitalize on individual strengths. The job developer may find it necessary to assess the individual and the work site more than once during the placement phase to determine an appropriate job match. This match is critical to successful employment.

Delineate the Activities and Skills Required in the Environment

After the environment is selected, a nondisabled person inventory is conducted. This is a strategy for delineating the activities and skills that would be performed by a nondisabled person to complete the work tasks within a given environment (Brown et al., 1985b) and is also referred to as task analysis. Generally, task analysis is completed during job development and becomes more specific as job training begins.

Assess the Performance of the Client with Disabilities

Once an analysis of the specific work requirements is recorded, an assessment of the client with disabilities is conducted to see how the client performs the job within the designated environment (Brown et al., 1985a). This analysis is helpful in determining the areas in which the client is independent and in which he or she needs support to complete the task. The type and level of support necessary to complete tasks should also be recorded. It is important to continue to collect these data over a period of time to allow the individual to adapt to the new environment and learn the necessary skills in a natural progression.

Identify Performance Discrepancies

After the client's performance is recorded in the actual work environment, the data are analyzed to identify discrepancies between the client's performance and the skills needed for the job (see Figure 1). These skills are then designated for troubleshooting.

Develop Training Strategies

The next step involves deciding how each of the skills for which the client needs support will be addressed in training. When clients are unable to work by typical means due to motor, sensory, or intellectual disabilities, it is necessary to do one of two things: develop individualized adaptations that involve modifying the environment, or teach compensatory strategies to enhance the client's functioning. Throughout the initial training phase, the service provider decides whether to teach the skill as a person without disabilities would perform it or to develop adaptations to facilitate more independent functioning.

BEYOND ADAPTIVE DEVICES

Along with the development of adaptive devices, it is important to consider other elements in the modification of work activities and work environments. York and Rainforth (1986) describe four aspects of job development that involve elements other than adaptive devices.

Providing Personal Assistance

Supported employment services offer training and various forms of ongoing support. In cases where personal assistance is necessary, service providers should consider integrated placement options, in which more than one individual benefits from job coaching services. For example, two individuals may work together in a complementary manner to perform their tasks. Individuals may be matched to tasks based on their strengths and preferences. Within the integrated work setting, relationships among the employer, co-workers, and supported employee offer opportunities for friendships and natural supports. Job coaches must be aware of opportunities to facilitate interactions between co-workers and supported employees.

Modifying Skills or Activities

Often individuals with severe disabilities may perform only part of the total work sequence. The job developer may find certain tasks appropriate for the employee that need to be done on a daily basis. In some cases it is possible for the supported employee to work with a nondisabled co-worker in completing a task.

Teaching the Use of Individual Adaptations

The preceding sections of this paper describe a process for developing adaptations to increase the independence or participation of disabled employees in performing work-related tasks. One must remember, however, that an adaptation only simplifies a task in some way; it does not teach the individual how to do the task (Baumgart et al., 1982). Once adaptations are developed, job training should include strategies for teaching the individual how to use the adaptation. Within this training process, the adaptation is evaluated for effectiveness and finely tuned to meet the needs of the person and situation.

Modifying the Physical and Social Environment

The physical and social environment of the workplace is an important consideration for employees with sensory impairments. In choosing a work environment, the job developer should consider the factors of space and distance in relation to the individual's mobility skills. Job sites that remain consistent in their physical arrangement should be identified. Tracking devices may be used to increase the employee's independence in mobility.

The remainder of this paper consists of two case histories. These profiles illustrate the use of the variety of adaptations discussed here for supported employees with sensory impairments.

MARY

Mary's Personal Profile

Mary is a 22-year-old woman who has been blind and deaf since birth. She has no functional vision and has worn a hearing aid since 1983. Mary has no verbal communication skills; she communicates through the use of tactile sign language, along with a tactile communication book that was developed during her school program. Mary is described as pleasant and

FIGURE 1. EXAMPLE OF DISCREPANCY ANALYSIS OF JOB SKILLS

Job Site: Beauty School

Activity: Laundry—Loading Washing Machine

Name: Sue M.

Date: January 22, 19—

Nondisabled Worker's Performance of Skills	*Performance Coding* [a]	*Client's Performance of Skills*	*Possible Adaptations/ Comments*
1. Enter laundry room.	–	Cannot locate independently.	Place cloth piece on laundry room door; teach trailing to door.
2. Locate dirty towels on the floor.	–	Cannot locate independently.	Place basket with strap under chute to catch towels.
3. Pick up towels to carry to washing machine.	–	Needs tactile sign: "pick up." Assistance needed to carry towels to machine.	Shoulder strap attached to basket makes carrying towels to washing machine easier.
4. Locate washing machine.	–	Cannot locate independently.	Client taught to track to washing machine.
5. Place towels inside washing machine.	+	(Client initially taught to feel rim of machine).	
6. Locate dial.	+	(Client initially guided to locate dial).	
7. Press buttons to identify appropriate load size and temperature.	–	Cannot distinguish between buttons.	Use Velcro to identify appropriate buttons.
8. Turn dial to starting mark.	–	Cannot identify starting mark.	Create raised mark using tube of Hi Marks.
9. Pull knob out to start washer.	+		
10. Locate box of laundry soap.	+		
11. Pour soap into measuring cup.	–	Overfills.	Replace soap box with bucket into which measuring cup can be dipped. Client taught to level cup with straight edge.
12. Pour soap into washing machine.	+		
13. Put measuring cup in bucket.	+		
14. Close lid.	+		

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[a] + indicates acceptable performance of skill; – indicates unacceptable performance of skill.

highly motivated in learning new tasks. Her facial expressions and gestures often communicate her true feelings. In her free time, Mary has gained proficiency in weaving with a floor loom.

Mary first entered the public school system from a state institution in 1979. During her education she received intensive training in a community-based school program for individuals with severe intellectual disabilities. This program enabled her to gain exposure to real-life learning experiences. She received community-based vocational training in the following work settings and tasks: a hospital, packaging surgical instruments; Howard Johnson, folding and stacking washcloths and bath mats in the laundry area; an office, collating, using a three-hole punch, and stamping; and another hospital, putting together patient information folders.

The community vocational experience offered through the school proved to be invaluable in giving Mary an opportunity to acquire job skills and related skills that would increase her chances of employment as an adult. She currently works as a supported employee in the central supply area of the hospital where she received vocational training as a student and earns 25 percent of the minimum wage. Mary receives direction from a job coach, who also supervises three other supported employees in the hospital. The role of the job coach includes checking Mary's work during key times of the job sequence, fostering communication within the work setting, and adapting equipment to increase her independence in the workplace.

Mary's Job Description

Mary's job involves packaging alcohol preparation packets in groups of 30 to be delivered throughout the hospital. Because Mary is unable to count, a cardboard jig containing 15 slots was developed. Mary was then taught to place two packets in each slot. She now does this independently. Once the packets are counted out, she transfers them to a paper bag, which is placed inside a rectangular Plexiglass container. Mary appears to understand her job and proceeds with the work sequence independently.

Factors Contributing to Mary's Success

A number of factors contributed to Mary's success on the job. Vocational training at the school level identified her skill strengths, a realistic pay arrangement, and a possible employment situation. The job provided a consistent opportunity to work on a daily basis. Mary had a consistent work station set up in a predictable format. Tactile sign language was used to teach the job sequence—this was thus a required skill of the job coach. The job coach then used tactile signing to reinforce Mary's understanding of correct and incorrect procedures.

Some adaptive equipment was developed at minimal expense to facilitate Mary's work. The rectangular Plexiglass container, which cost $15, was designed by Mary's teacher. The cardboard counting jig was created at minimal cost. Dycem, a nonslip plastic material, was used, costing $33.95 for a piece 16 inches x 1 yard.

Mary's placement was also successful because it provid her with a variety of opportunities. She was able to intera with her co-workers through the use of sign language. A voc tional trainer facilitated this social interaction and taught ta tile sign language to the co-workers. (Interpreting and signi services were made available through the state Division Vocational Rehabilitation. It should be noted that services fro state offices for hearing impairment or state services for t blind can be used to ensure that individuals with sensory i pairments receive effective communication services.) Ma also had the opportunity to learn related job skills, such changing money to make purchases at break time, co municating in purchasing food items, and communicating work-related social functions.

RICK AND SUE

Rick and Sue work together at Capri Beauty School, a su ported employment site, doing laundry and related tasks. The each work 20 hours per week, earning a subminimum wag and are both being trained by one job coach. Rick and Su have different responsibilities, and together they complete th tasks of one nondisabled worker in a complementary fashio Every day they begin by signing "good morning" to their c workers. The co-workers have been taught to identify themselve with a name sign and return the greeting in tactile sign languag

Sue's Personal Profile

Sue is a 21-year-old woman who lives in a state institution. Sh has a severe hearing loss and wears hearing aids. She als has a severe visual impairment. Although she has bee described after ophthalmological examinations as having n reaction to any visual stimuli in either eye, this conflicts wit the functional vision that Sue demonstrates in the vocationa setting. She often uses overhead lighting to orient herself i familiar hallways. Sue ambulates independently and has bee taught to trail surfaces, or else she travels with a sighted person. She communicates through the use of signs and receive information either through signing or a tactile display. Sue i described as a strong-willed individual with a spontaneous personality. She enjoys communicating with people through signs and is extremely capable in completing work tasks. Sue has received a public school education, which afforded her vocational training opportunities in nine different sites over a period of six years, including offices, hotels, hospitals, and restaurants.

Sue's Job Description

Sue's job involves loading towels into the washing machine and transferring the laundry to the dryer. A piece of Velcro has been attached to the appropriate selection setting to allow Sue to set the dials independently. To increase Sue's independence in transferring the laundry from the dryer back to the folding table, she carries a laundry basket strapped around he shoulder. When Sue returns with the towels, Rick folds the towels while Sue wraps permanent kits.

The process of wrapping kits involves discriminating between two different sized combs and brushes and then rolling them inside a towel. To increase independence in discriminating skills, the brushes and combs are kept separate within a compartmentalized caddy. Sue prefers a variety of tasks and enjoys being able to sit and stand at different times during the workday.

Rick's Personal Profile

Rick is a 21-year-old individual who recently graduated from high school. He spent nine years of his life in a state institution, after which he was adopted. He lives with his adoptive family in a rural farm community.

Rick is considered severely mentally retarded, with auditory dysfunction and visual impairment as a result of congenital rubella syndrome. He wears glasses and responds to bright fluorescent colors and light patterns. He is nonverbal and communicates through gestures, limited tactile sign language, and fluorescent, tactile communication cards.

Much of Rick's success in his current job placement is attributed to the training he received in school. He received vocational training in hotel housekeeping and laundry tasks, packaging produce at a food co-op, and clerical tasks. As a result of his vocational training, Rick's strengths and preferences in the area of laundry skills became apparent, which accounts for his current job placement. In his leisure time, Rick enjoys riding a tandem bicycle or stationary bike; playing video games; having french fries, malts, and pizza at restaurants; and weaving bright colors with a simple table loom.

Rick's Job Description

Rick's job involves folding towels and delivering permanent kits. A jig is used to increase his independence and accuracy in folding towels.

Once the towels have been rolled into permanent kits, Rick delivers them to sink stations. He carries the permanent kits in a plastic caddy and has been taught to track his way to the sink area. At present, Rick requires assistance in making sure the kits are placed in the proper cupboards.

Factors Contributing to Success for Sue and Rick

A variety of factors make this a successful job placement for Sue and Rick. Folding towels and other laundry tasks involve the use of tactile feedback, which is appropriate for individuals with sensory impairments, and these tasks offer the disabled employees a consistent routine. In addition, the job offers the clients opportunities to interact with their co-workers, while co-workers increase their ability to use sign language.

Tactile signing was used as an instructional strategy, and the following adaptations and materials were used to modify the jobs for Rick and Sue: a Plexiglass towel-folding adaptation ($25); a vibrating timer to time laundry loads ($10); a shoulder strap for the clothes baskets ($10); Velcro ($2 per package); and a tube of Hi Marks, a specialized marking material ($4 per tube).

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Job Modifications for Blind Physical Therapists

Deborah Churchill

Physical therapy is a dynamic and integral part of the modern health care delivery system. Physical therapists and assistants work with patients to help them regain strength and motion lost through injury or disease, to relieve pain, and to promote healing. The treatments they perform involve such modalities as water, heat and cold, electricity, and exercise—and virtually all these treatments can be effectively carried out by blind therapists.

Over the past 10 years, St. Mary's Campus of the College of St. Catherine in Minneapolis, Minnesota, has successfully trained and placed in employment 14 blind and visually impaired physical therapist assistants. These graduates vary widely in degree of functional vision, so we are developing a growing body of information on job accommodations for both totally blind and low vision practitioners. In the interest of clarity, this presentation is based on the experience of one individual who is blind but has light perception. This woman worked for approximately two years as a physicial therapist assistant and then went on to complete baccalaureate-level training in physical therapy. She is now employed as a registered physical therapist. Although the level of responsibility is quite different for these two occupations, the particular job modifications are very similiar. Modifications are necessary in three basic areas: (1) information management, (2) equipment, and (3) technique.

INFORMATION MANAGEMENT

As in many employment settings, a major challenge for a visually impaired person in a physical therapy department—for example, in a hospital—is gaining access to printed information. In this case, the blind therapist must be able to gather pertinent information from the patient's medical history and the physician's orders, to provide documentation of the treatments she performs and the patient's progress, and to bill the patient for services. In most departments, a ward secretary can tape-record the sections of the patient's cha as requested by the therapist. The therapist then prepare braille cards on each of her patients with information c diagnosis, therapy goals, and treatments. Progress notes ar generally typed directly into the patient's chart, but som facilities use a voice-dictation service. Individually constructe templates are utilized for completing the facility's billing an standard evaluation forms. Several therapists are explorin how speech or braille output microcomputers might simplif record-keeping tasks on the job.

EQUIPMENT

A number of pieces of commercially available adaptive equip ment are useful in the physical therapy setting. Some neces sary items are not available, and so modifications need to b made to existing equipment. The particular type of physica therapy department, as well as the individual needs of th therapist, will determine how extensive these equipment adap tations will need to be. The following adaptative equipmer is used in an acute-care physical therapy setting:

- *Voice output thermometer* for determining appropriate ter peratures of paraffin and hydrotherapy treatments
- *Voice output or tactile sphygmomanometer* for evaluating patient's blood pressure tolerance when moving to uprigh positions.
- *Voice output meter reader*, designed specifically for inter face with physical therapy equipment using analog needl metering, such as short-wave diathermy and ultrasoun treatment machines.
- *Tactile goniometer* for measuring joint motion, using notches cut into a standard metal device.
- *Talking clocks and braille timers* for measuring pulse rates an timing short-duration treatments such as ultraviolet light.

- *Individually prepared braille overlays of clear adhesive plastic (Labelon)* for marking various pieces of equipment for independent operation, for example, traction setups and electrical stimulation units.

TECHNIQUE

Modifications must also be made in some of the techniques used by blind therapists. Most physical therapy techniques are performed in the same way by sighted and visually impaired therapists, with the exception of techniques for monitoring patients' performances, checking such things as angle of pull on pulley ropes, and making measurements.

In particular, blind therapists must use very different techniques in the area of ambulation and gait training. Blind therapists need to position themselves differently in order to use their hands to monitor the position of the patient's head and shoulders and the placement of assistive devices such as a cane or crutches. They also check hip and leg musculature to determine how much weight is being borne by an extremity. They use their feet to evaluate placement of the patient's feet and assistive devices—for example, whether the patient is toeing in or out, the feet are wide enough apart for good balance, and the crutches are placed in a safe position on the stairs. The blind therapist may also do extensive manual testing of muscles prior to walking with a patient for the first time to predict any difficulties the patient might have in ambulation as a result of muscular weakness. These activities must be modified in numerous ways by the blind therapist to provide safe and effective treatment.

JOB OUTLOOK

The job modifications required by a blind therapist are fairly extensive, but most are simple and inexpensive. The job outlook for practitioners in physical therapy is excellent: The Department of Labor predicts a 50 percent increase in employment opportunities in physical therapy by the end of the 1980s. Visually impaired therapists are increasingly recognized and accepted in the field, as evidenced by the formation in 1986 of RADAR, an information-sharing network of visually impaired physical therapists and assistants. We can anticipate a growing interest on the part of visually impaired individuals in this dynamic and rewarding profession.

The Vocational Education Readiness Test in Basic Wiring

Lynn W. McBroom

Although job modifications for blind and visually impaired persons are often important for successful performance of a job, another integral component of this success is work assessment. Work assessment devices that are adapted for blind or visually impaired persons can assist in determining whether a person is qualified for a particular job. Adaptive assessment tools and methods allow test results to be standardized without regard to the visual ability of the candidate. The object of these adaptations is to separate impairment in visual functioning from the ability to perform a particular task.

The Rehabilitation Research and Training Center on Blindness and Low Vision (RRTC-BLV) at Mississippi State University has adapted the Vocational Education Readiness Test in Basic Wiring (VERT-BW) (Thomas, Brownlee, Calloway, & Shill, 1978) to assess the readiness of a blind or visually impaired person to enter a basic wiring training program. Most work samples developed for use in rehabilitation facilities focus on immediate job placement. The VERT-BW project, in contrast, focuses on the need for work samples to evaluate clients' entry-level vocational needs.

CLIENT INFORMATION

In the RRTC-BLV field study, the norm group contained 35 blind and visually impaired respondents randomly selected from the Meridian and Jackson Workshops of Mississippi Industries for the Blind and from the Regional Rehabilitation Center in Tupelo, Mississippi. The respondents were 23 males and 12 females who ranged in age from 21 to 56. The average educational level was 11.34 years, with the majority having attended nonresidential schools. The average age of onset of blindness or visual impairment was 11.34 years. Approximately 77 percent of the respondents were totally or legally blind, and the remainder were visually impaired. More than four-fifths had no disability other than blindness. A majority of the respondents had previous training or work experience in basic wiring. The employment histories indicated that the respondents had been engaged in a variety of different occupations (benchwork, machine trades, service jobs, and agriculture, fishing, and forestry work). Respondents having no previous jobs constituted 2.9 percent of the group.

DATA COLLECTION AND MODIFICATION

Although both blind and sighted people are asked to perform identical tasks on the VERT-BW, different media are frequently used. For example, a sighted person uses visual stimuli to discriminate among the various colors of electrical wires. A blind or visually impaired person may perform the same discriminations using the auditory stimuli of a light-sensing device. The other adaptations used in this work sample are braille and large print rulers.

The VERT-BW work sample was administered, and time and quality measures were collected for each of seven tasks (measuring skills, wire stripper, pigtail splice, insulating spliced wires, plastic solderless connectors, Type-B solderless connectors, and duplex wall receptacle). Test-retest reliability coefficients were calculated by correlating scores obtained in two administrations of the VERT-BW conducted within a one-month interval. Test scores consisted of a quality measure (either number of errors or quality rating of the task) and a time measure (the length of time required to complete the task). The results indicate that the measuring skills, wire stripper, pigtail splice, insulating spliced wires, Type-B solderless connectors, and duplex wall receptacle tasks are reliable measures of both time and quality. The plastic solderless connectors task is reliable in regard to quality of performance, but not in regard to performance time.

The concurrent validity of this work sample was obtained by examining the relationship between the respondents' scores on all tasks specified in the VERT-BW work sample and the respondents' job ratings. Separate analysis was again performed for quality scores and for time scores. In this analysis, only the plastic solderless connectors task demonstrated significant concurrent validity for both time and quality. All other tasks showed significant concurrent validity for quality, but not time. However, for all these tasks except insulating spliced wires, the correlation for time was low, but in the predicted positive direction.

Based on the test-retest reliability and the concurrent validity analyses, all seven tasks are recommended for use by vocational evaluators. The VERT-BW work sample should be used in conjunction with other tests and information to obtain a more complete vocational evaluation of people who are blind or have low vision.

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Part III

CASE STUDIES

Computer Applications for an Attorney Who Is Blind

George A. Saiki

The client in the case to be described is a 29-year-old, congenitally blind woman whose total loss of vision was due to retinopathy of prematurity. Her educational background includes mainstreaming in day school and secondary education and obtaining a bachelor's degree in education and, ultimately, a law degree. In the past she has used reader services, taped texts, a Kurzweil Reading Machine, stenomask and tape recorder, slate and stylus, and a Perkins braillewriter.

The client uses a dog guide and lives independently, with homemaker service three hours per week for her personal mail, grocery shopping, and spot cleaning. Her physical health is excellent, and she has made an excellent adjustment to life as a single, professional woman.

JOB DESCRIPTION

The client is an assistant attorney general, working primarily with wage claims from the state Department of Labor and researching opinions related to labor law. The position requires a law degree from an accredited law school but no experience as an attorney. The client is required to do legal research, draft opinions, complete forms, negotiate settlements, collect pertinent information, and organize, consolidate, and integrate data. She must be able to dictate, make notes, file materials for her own use, proof her dictation, complete forms, take depositions, and do library research.

JOB MODIFICATIONS

A number of job modifications were devised for the client. She was to have a reader for a minimum of two hours per day, which would be paid for by the employer. She would also have a paperless braille device interfaced with a personal computer that has a speech synthesizer and appropriate software. The personal computer would interface with a mainframe computer, a dedicated word processor, a modem, and a dot matrix printer. Software would include word processing software, a braille-to-print/print-to-braille conversion program, and appropriate software for the terminal emulations. In addition, the employer was to pay for all costs to access several legal databases for library research.

The state Division of Vocational Rehabilitation provided a reader for the first six months at a cost of approximately $5,000. The cost of the hardware and software together totaled approximately $16,000, as shown in Table 1. The employer allowed the purchase of modular furniture that was specifically designed for the client's particular needs and compatible with her equipment. This cost about $1,300.

CURRENT JOB STATUS

The client is currently using a reader for three hours per day. However, we are optimistic that with the use of the employer's new word processor and her personal computer, she will be able to achieve her goal of limiting the reader to two hours per day, because she will be able to access, proof, and correct her dictation.

This client's employer has been unusually cooperative. However, it is important to note that the client is an ambitious, motivated individual who has not only worked hard on the job, but has also taken an active interest in various community activities and advocacy functions for people with disabilities.

TABLE 1. HARDWARE AND SOFTWARE FOR ATTORNEY'S JOB MODIFICATIONS

Equipment	*Cost*
Personal computer: IBM PC XT with 20 megabyte hard disk (½ length controller board), serial port, 360 kilobyte floppy disk, expanded memory to 640 kilobytes, and 12-inch monochrome monitor (for sighted users)	$ 4,500
Speech synthesizer and software: VERT Plus for the PC, from Telesensory Systems, Inc.	2,500
3278 VERT accessory package: 3278 terminal emulation for the PC, from Telesensory Systems, Inc.	1,295
VERT/Qwerty word processing software	150
BRAT Software System: interfaces VersaBraille II to IBM PC XT	295
VersaBraille II paperless braille device	6,500
5250 Emulator Board: 5250 terminal emulation for the employer's dedicated word processor	725
Total	15,965

AMERICAN FOUNDATION FOR THE BLIND
15 WEST 16th STREET
NEW YORK, N.Y. 10011

Back to First Grade: A Study in Rehabilitation

Wesley Hayes and Faith Weathington

The client, a 42-year-old woman, had taught first grade in a county public school system for 19 years. She had completed college and held teaching certification for kindergarten through sixth grade. At the time of her entry into the adult rehabilitation facility of the Alabama Institute for Deaf and Blind, she was insulin-dependent for control of diabetes. Diabetic retinopathy had resulted in corrected visual acuities of 20/100 OD and 20/200 OS, with considerable daily fluctuation of subjective visual ability. Sequelae of the diabetes included diabetic neuropathy and chronic osteomyelitis of the lower extremities. Because of these conditions, the client experienced greatly reduced tactile sensitivity, required orthopedic surgery, and depended on a wheelchair for mobility. She was, however, able to live alone in her own home.

The client was referred to the facility's program for evaluation, assistance with mobility, braille assessment, help with adaptive activities of daily living, and assessment for technological aids. The vocational/rehabilitation counselor wanted to evaluate her potential for returning to the classroom. The client was an intelligent, independent, and pleasant woman who was eager to explore adaptations and work possibilities.

JOB DESCRIPTION

Classroom teaching at the first-grade level requires a variety of abilities, all well known to the client. Specific areas of her concern related to the necessity to complete paperwork, including lesson plans, the grading of papers, and required reports. Other areas of concern were the teacher's need for mobility and the need for visually monitoring students' behavior during playground and lunchroom periods. Typical first-grade classes comprise 23 to 27 children who are 6 years old.

JOB MODIFICATIONS

The primary job modification addressed in the rehabilitation program involved efficient adaptation of the paperwork requirements. Visual irregularities not defined by acuities, as well as the progressive nature of the client's disorder, led to the assessment of her readiness to learn braille. This was carried out using the *Kansas Braille Reading-Readiness Book* (Stocker, 1979), sandpaper blocks, different textures of braille paper, and jumbo dot braille.

The VersaBraille, a microcomputer made by Telesensory Systems, Inc., was introduced because the dots on the braille line are more solid in texture and can be more readily identified tactually. The VersaBraille has a six-key keyboard for braille and stores material electronically on a cassette tape. The stored material can then be recalled and read tactually on a 20-cell braille display line. This microcomputer made it possible for the client to read braille with a very high accuracy rate. Lessons from the *Braille Series* (1984), which had been entered onto VersaBraille cassettes, were utilized. As the client began to write, edit, and print, the potential for teaching applications involving personal notes, documents, lesson plans, lectures, and so forth became apparent. To perform these tasks, the client had to be instructed in the use of all the word processing functions.

The client found it easier to transcribe from audio cassette to braille using the VersaBraille when she wrote and copied from her paper visually. The instructor, who was himself totally blind due to retinitis pigmentosa, realized that another assistive device should be explored to maximize her visual preference. He therefore obtained consultation from the low vision technical instructor, and the client was trained in the use of a closed-circuit television to scan enlarged images of her printed work.

The combination of these devices and skills predicated the introduction of the Apple IIe computer, which revealed the client's need to improve her typing skills and to become desensitized to and less intimidated by the computer itself. These obstacles were overcome through the playing of braille computer games, which combined the use of the computer keyboard and braille signs and contractions.

After successfully completing this training, the client then proceeded to learn the most powerful, useful, and versatile word processing program for the blind, the Braille-Edit program written by David Halladay of Raised Dot Computing. This word processing program is designed to work with the Apple IIe on a wide variety of screen modes, voice devices, braille devices, and inkprint printers. Braille-Edit can perform a broad range of text-editing operations using voice, screen, and braille, including translation into Grade 2 braille and back into regular text. When the client has learned all the functions, she will be capable of performing more word processing than a sighted counterpart, because of the braille translators and the interfacing features. The Echo voice synthesizer was used for reinforcement for the instructor to monitor her work. The client may need to use this system if her residual vision diminishes at some point.

The client returned to work as a substitute teacher in the same school system in which she was previously employed. A low vision device, the RCA Overseer, was provided by Vocational Rehabilitation Services at a cost of $1,635. This unit has portable features that allow the client to use it at home as well as at school. She used this equipment to review lesson plans and grade papers, as well as for personal use. Vocational Rehabilitation Services did not purchase the computer system on which the client was trained because she was working as a substitute rather than on a full-time basis. She was informed she would have to purchase this equipment herself. However, the school system had Apple IIe computers for the children that were available to the client.

CURRENT JOB STATUS

The client was contacted recently for follow-up on her curren job status. She is employed as a teacher of preschool childre at a local private school and two mornings a week teache a class of 14 who are 3 years old. In addition, she teache piano two afternoons a week and works one full day a wee in a public school as a resource teacher in remedial reading

The client emphasized that she feels comfortable wit this type of flexible schedule. Although she was not isolate or neglected in the public school, she feels much more sup ported and independent in her current jobs. Many factor contribute to her current job satisfaction: physical accessibility content compatibility of teaching materials, and greatly reduce physical and psychological stress.

The client is optimistic about her future in the work force for several reasons. She has a satisfying job in a supportive environment and thus maintains an active, useful, and indepen dent life-style. The private school at which she teaches plans to expand their preschool program to five days a week, which will extend the client's work hours. Alternatively, the state o Alabama has recently mandated public kindergartens, which could give the client new job opportunities. The client hopes to purchase her own Apple computer when prices drop with the introduction of new models. She feels that, having overcome the intimidation of using this equipment through training at the E. H. Gentry Technical Facility, she will be able to overcome future challenges of job demands or decreasing vision.

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Job Modifications for a Blind Bilateral Amputee Social Worker

Sue M. Story

The Southeastern Blind Rehabilitation Center was asked to analyze the job tasks of a social worker who was totally blind and who had had both arms amputated and to make recommendations about any necessary devices or job modifications. Up to this time, the client was using volunteers to perform any tasks that he could not accomplish himself. These volunteers were becoming less reliable, and the client's work load was increasing.

The client was using prosthetic hooks, and he also had a minor hearing impairment. He had participated in a rehabilitation program for blind individuals while he had some residual vision but had recently lost his remaining vision. After completing the rehabilitation program, he had received a bachelor's degree and then master's degree in rehabilitation counseling and counseling psychology. Previous jobs included a position at the Cybernetic Research Institute and a job as a counselor in an alcohol treatment program sponsored by the Veterans Administration (VA).

JOB REQUIREMENTS

The client's current job is as a readjustment counseling therapist at a VET center that is part of the VA system. It requires him to complete an intake questionnaire on potential clients; write progress reports and plans for individuals currently being served; maintain a record of the number of clients being served, the types of services being provided, the number of contacts, and the amount of time spent on each contact; produce a quarterly report of his activities; provide counseling, including written documentation; read a variety of publications and reports; and communicate to others in written form.

SYSTEM SELECTION AND MODIFICATIONS

Based on the job requirements and the client's abilities, a computer with speech output seemed to be the obvious solution for both his written communication and record-keeping needs. Use of a standard keyboard was not considered feasible, so two alternatives for keyboard input were identified. The first was a speech recognition device for the IBM computer. Although this system represents a considerable advance, its vocabulary was too limited to serve the client's word processing needs effectively.

The second alternative, which was ultimately used, was an Apple IIe with adaptive modifications. The final system consisted of an Enhanced Apple IIe computer with 128K RAM, an Apple][monitor, Duo 5¼-inch disk drives, two 3½-inch Uni disk drives daisy chained together, an Apple ImageWriter II printer, a Kensington System Saver, an Adaptive Firmware Card, a Morse code keyer, an Echo+ speech synthesizer, a ProWORDS/ ProTERM+ software program, a Sensible Speller software program, and a File-Talk software program.

To replace the standard keyboard, the Adaptive Firmware Card, configured for Morse code input, was selected. The Adaptive Firmware Card has a total of 16 different setups with nine different devices that can be used. Some of these work well with speech, but others do not work at all. Morse code input is one of the input options that works well with speech. Modification of the double-paddled Morse code key allowed the client to place his hook inside the paddles and press to the left and right to enter the dot and dash codes. A quarter-inch shelf was built onto the Uni disk drives with an extension on the left. This allowed the disk to be moved down and over so that it lined up with the opening. We planned to use 5¼-inch Duo disk drives for programs that were not compatible with the Uni drives and as a way to copy information sent on a 5¼-inch disk to the 3½-inch disk. No other modifications or adaptations were required on any of the other pieces of hardware.

For the client's reading needs, the Kurzweil Reading Machine was recommended. Once again, no modifications were needed. Instead, the client used his feet to enter commands into the keyboard.

Finally, the rehabilitation center recommended that an assistant be hired on a full-time basis to help the client with materials that could not be read by the Kurzweil Reading Machine, as well as with activities such as mailing correspondence, changing the batteries on the Adaptive Firmware Card, and reinitializing the system. The assistant would be shared with others in the department as time permitted.

The VA Central Office in Washington purchased the Kurzweil Reading Machine at a cost of $20,000. The Southeastern Blind Rehabilitation Center purchased the Apple computer and adaptive equipment at a cost of $4,000. This equipment will be loaned to the client for as long as he has a use for and his local VA medical center is responsible for any repai to the equipment that become necessary.

CURRENT JOB STATUS

The client's current job with the VET center is being disco tinued, and he will shortly be transferring to another counse ing position within the VA medical center. Because of this, was impossible to determine through follow-up the level functioning he had achieved. The client was referred to th visual impairment service team coordinator and his local voc tional rehabilitation counselor for follow-up.

Devices and Equipment for a Low Vision Executive

Jay Stiteley

The client in question was self-employed as a cabinetmaker for seven years. He then became the state coordinator of the Washington State Vocational Industrial Clubs of America (VICA), an organization that prepares high school students for industrial employment. He has a bachelor of science degree in industrial technology with a minor in business administration. Currently, the client is state director of the VICA program, working directly under the superintendent of public instruction, Department of Education, Washington State Schools.

The client is a Vietnam veteran and became visually impaired while in Vietnam. As a result of his injury, he has light perception only in his left eye, and the right eye has a field restriction of 15 to 25 degrees with scattered scotomas and a visual acuity of 20/200.

JOB DESCRIPTION

As state director of VICA, the client has a variety of duties, each of which requires different skills and activities. These include the following functions:

- Coordinates and supervises all the activities pertaining to the VICA programs. To complete this portion of the job, he is required to carry on extensive correspondence and schedule and conduct state, regional, and local meetings.
- Serves as primary resource to the regional and state officers. In this capacity he must have access to a wide range of file cards, magazines, and newspapers to maintain and expand his knowledge of resources.
- Plans the annual budget for conferences, competitions, and travel; provides background information for investment planning. This requires written reports with the facts and figures to back up his statements.
- Plans, coordinates, and supervises the annual Skills Olympics. This requires contracting with local industries to provide judges for the competency-based events of the Olympics.
- Prepares quarterly and annual reports to the board. This requires extensive writing.
- Plans, develops, and writes the training manuals and newsletters for the VICA leadership programs. This entails extensive writing and use of graphics programs to generate visually pleasing publications and requires reading a great many printed reports, news articles, and letters.
- Develops a membership list so that letters, reports, and resources can be disseminated quickly. To do this effectively, a database is essential.
- Travels throughout the state. This requires the ability to read street and building signs, bus numbers, and overhead monitors at airports and train and bus depots.

JOB MODIFICATIONS

Low Vision Adaptations

At the time of the original request for rehabilitation services, the amount of the client's functional residual vision was still undetermined. The client had initiated some research into computer access devices on his own, based on his understanding of his vision and his knowledge of computers. He knew that the Veterans Administration issued the Kurzweil Reading Machine to employed service-connected veterans and believed that this would meet his reading needs while in his office. His research led him to the Viewscan Text system, which would provide him with a portable means of accessing computers when he was visiting the various schools in the state.

On admission to the Western Blind Rehabilitation Center in Palo Alto, California, the client was given a low vision evaluation by a low vision specialist, which took approximately two hours. The Tangent Screen Test was given to identify the field restrictions and scattered scotomas, and visual acuity was determined by the Snellen Distance and the Jaeger Near Acuity tests. Next, the optometrist examined the client in two 1½-hour sessions. Based on the results of these evaluations, the following low vision devices were prescribed:

Bifocal lens. The upper portion is a 6X microscopic lens for reading print; the lower portion is a +2.5 lens used for seeing while writing. The client was advised not to walk around while wearing these glasses. At the conclusion of training, the client could read magazine-size print at a rate of 121 words a minute, at a distance of 4 cm, with good lighting over the right shoulder, for a duration of 50 to 60 minutes. The bifocal lens provides an efficient and portable means of addressing the client's reading needs outside the office.

A 4X spectacle-mounted monocular with a +2.00D reading cap. This is a portable means for reading computer monitors. Using the monocular, the client can read at a distance of 30 cm, at a rate of 38 to 42 words a minute, for a duration of 20 to 25 minutes. The monocular enlarges the individual dots that make up each letter shown on the computer monitor, which makes the identification of each letter more difficult. This, combined with the reduced field, is responsible for the drastic drop in reading speed. Although it is slower, it meets the client's needs adequately.

Corning 527 glasses. These glasses help to control outdoor light.

8X monocular. This device enables the client to read street and building signs and airport, bus, and train depot monitors and to identify local bus numbers.

The direct training time was 6 hours for these four low vision devices. The client completed an additional 10 hours of independent work.

Computers and Access Equipment

The rest of the job modification for this client pertained to his computer. Training on the Kurzweil Reading Machine was conducted concurrently with the client's low vision evaluation and training. However, the client decided that the Kurzweil Reading Machine was not the appropriate device for him at that time because of his level of residual vision.

Three large print access systems were demonstrated to the client: the Viewscan Text system, the PC Lens, and the Vista/Vantage system. After some consideration, the client chose the Vista/Vantage system. The low vision devices already prescribed could meet his reading needs when he was away from his office. The Vantage, a closed-circuit television could help him address the volume of reading in the office Finally, after discussing the relative merits of the other tw access systems, the client decided that the Vista/Vantag system met more of his needs.

The following equipment was recommended for the clien (the Veterans Administration purchased the first four items o the list):

IBM PC XT, with 640K RAM, 10 megabyte hard disk driv and single disk drive, color monitor, parallel and serial cards and the IBM Proprinter with necessary cables (cost, $2,987)

Vista large print display system (cost, $1,700). This system was selected because of the client's need to work with graphic to create newsletters and training materials.

Vantage closed-circuit television system (cost, $2,495) Although the client's reading rates are high with the 6X microscopic lens, the short duration of his reading ability was a concern, considering the volume of reading he is required to do. With a closed-circuit television, his reading rate is only slightly lower, and the duration could be doubled. When the client begins to tire, he can enlarge the print further and continue working. This particular system was chosen because i would interface with the Vista, giving split-screen capability.

WordPerfect and dBase III (cost, $588). WordPerfect is a word processing program, and dBase III is a database manager. The former enables the client to produce the extensive correspondence and training materials required by his job. The latter makes possible the creation of the membership list and resource file.

Ability, an integrated word processing, database, spreadsheet, and graphics production program (cost, $99). This was purchased by the employer, mainly because of the integrated feature.

Print Shop, Newsroom, and Newsmaker (cost, $350). The client purchased these programs to aid him in the creation o the newsletter and training materials.

CURRENT JOB STATUS

The employer is extremely supportive of the client and the job modifications. The use of the computer enables the client to shoulder more responsibility in his job.

Alternatives for a Design Engineer with Low Vision

Robert McGillivray

As a rehabilitation engineer in the field of low vision, I work with others in a variety of disciplines to develop the most effective methods of helping individuals with a vision impairment to accomplish specific job activities. I become involved with the visually impaired person as a sort of troubleshooter when he or she is applying for a new position or when difficulties arise from new job responsibilities, changes in vision, or the use of new tools on the job.

Working with the visually impaired individual, the vocational rehabilitation counselor, the employer, and, in particular, the low vision clinician, I gather specific information at the work site and assess recommended low vision aids, devices, and techniques to determine a realistic vision rehabilitation plan. Combining these varied resources with testing and refining recommendations in the field has allowed the implementation of successful job modifications for many individuals with low vision. This paper will describe one such case.

CLIENT INFORMATION

Mr. R is a 30-year-old design engineer employed in the construction field, who recently experienced a sudden loss of visual acuity due to Leber's optic atrophy. As a result of this impairment, Mr. R suffered a loss in his ability to read and draft and was no longer able to drive to construction sites to conduct inspections.

To meet his immediate need, Mr. R was registered with the Massachusetts Commission for the Blind and subsequently referred to a low vision clinic. The low vision clinician provided microscopic reading glasses and a telescopic aid and recommended a closed-circuit television (CCTV) magnification system. On the recommendation of the commission, I conducted a job site evaluation and provided the CCTV system. Although these devices were helpful, Mr. R was not able to perform his previous job at a competitive level.

JOB MODIFICATIONS

With the company and Mr. R's vocational rehabilitation counselor, we began to explore alternative jobs for him. Among them was the position of design draftsman, whose major activities could be performed on a CAD (computer-aided design) engineering graphics system. Since areas on the computer's drawing screen could be enlarged, we thought this might have some potential.

Because the company did not currently use this kind of system in its regional office, an evaluation was set up with Hewlett-Packard, the manufacturer of such a system. The system display screen consisted of a large drawing area and a 2-inch wide strip along the right side on which the graphic editor menu was displayed. The multicolumn list of menu commands changed, depending on the edit command chosen. The drawings are made using an electronic pen on a tablet. By using the enlarging feature of the system along with an oversized, high contrast cursor, Mr. R was able to accomplish the drawing task with only a little practice.

However, the editor menu could not be magnified. This menu normally consists of 24 commands displayed in two columns and 21 features in three columns, all in characters approximately 3/16 of an inch in height (normal computer display size). To help Mr. R read this, telescopic aids and reading lenses were tried. With the 6X reading lenses, he could read the menu only at 1¾ inches. Moreover, using the reading lenses would be slow and uncomfortable and would interfere with viewing the drawing screen.

To give Mr. R the magnification of this limited area of the screen that he needed to be able to read at a comfortable and effective working distance, I suggested video magnification. A CCTV video camera was mounted on a tripod at 3 feet from the screen. A 19-inch CCTV monitor was positioned next to the

CAD system, and adjustments were made to display an enlarged view of a section of the menu on the 19-inch monitor. Mr. R was able to read the menu comfortably at a normal working distance. At the magnification needed, the full width of the menu could be displayed on the 19-inch monitor, but better results could be obtained with a 23-inch monitor.

A method now had to be found to be able to scan the menu with the CCTV camera. To scan up and down the menu, an electronic pan and tilt system, controlled by foot pedals, was recommended so that Mr. R would not have to move his hand away from the drawing tablet.

CURRENT JOB STATUS

Mr. R was sent for two weeks' training on the modified system at the central office of his company. The company is now in the process of purchasing the CAD system for the regional office, because they feel this tool will make Mr. R more competitive in his new job. Overall, the modifications recommended were a video camera with electronic pan and tilt and foot pedals, and a 23-inch video display monitor. Mr. R's case is one of the many in which a job modification has proved successful through the use of experts in the clinic and in the field.

A Full-Time Placement for a Telemarketing Sales Representative

Sam Rogers

Sally began working with a placement specialist in March 1986. At the time of referral, she was working out of her home in a part-time sales/marketing position for a small business, selling and scheduling the delivery of helium balloons. Sally's goal was to obtain a full-time position working with people on the telephone and using her skills in public relations. She desired a more challenging position that would provide additional funds needed to support herself and her son. Her experience and employment history supported her goal.

Sally became totally blind at age 16 from glaucoma. She has a high school diploma and has taken several noncredit courses, such as Introduction to Computers, to improve her job-related skills. Most of her work experience has been in the Business Enterprise Program, which is overseen by Arizona's State Services for the Blind and Visually Impaired. She operated her own vending stand for five years, and prior to that, she assisted her husband in running a stand.

JOB DESCRIPTION

The client was placed in July 1986. In her position as telemarketing representative, Sally is responsible for contacting preestablished and new customers on the telephone to "soft-sell" a variety of styles of caskets. She is accountable for the input of orders into the computer as well as for the checking of customer credit. Caskets are made to order, and information regarding color, type of material, handles, style, and so forth is taken from the customer and entered into the computer. The computer prints the work order to manufacture the caskets and bills the customer for the product. Sally calls the entire customer list every two weeks.

JOB MODIFICATIONS

All costs for the equipment Sally uses on the job were incurred by the State of Arizona Department of Economic Security, Services for the Blind and Visually Impaired. The following job modifications were introduced:

- APC clone computer with Echo voice synthesizer to access customer information. It includes a dual disk drive, two RS232 serial ports, a color graphics card, a black and white monitor, and Screen-Talk and Crosstalk software packages (cost, $2,400).
- A Ventel II telephone headset for easy retrieval of information while speaking on the telephone (cost, $226).
- A raised braille map of the United States to give Sally access to information on the routing of trucks for hauling the product. This assisted in decision making regarding marketing in specific regions of the country (cost, $5).
- A brailled book of customer accounts and product information to enable Sally to obtain product descriptions with prices and freight charges. Since Sally enlisted the aid of a friend and together they brailled this information, there was no cost for this.
- Approximately 40 hours of training in computer terminal functions, a speech synthesizer program, and an employer accounts program. Although the placement specialist provided much of this training, some outside assistance was obtained (cost, $75).
- Orientation and mobility training in the work setting (cost, $116).
- A braillewriter to enable Sally to take notes. Since Sally already owned a braillewriter, this cost was not transferred to this placement.

The total cost of job modifications for this placement was $2,822. The specified costs do not reflect time spent by the placement specialist.

Several problems were encountered in arranging this placement. The customer's computer was not a common brand, which made compatibility with the other equipment more difficult. Experts were enlisted to assist in the setup only after much deliberation regarding the configuration necessary to make the PC clone and software work well with the employer's mainframe. Neither the salesperson nor the agency had enough knowledge to provide quality installation and follow-up. Not until six weeks after the communications software package was installed did we realize that the software package we had purchased was not as compatible with the equipment as others available on the market. Training was needed for staff on interfacing of computer equipment in the work environment. Since this placement, State Services for the Blind and Visually Impaired has available a trained staff member to assist in recommending and installing equipment when needed.

Providing computer literacy training for the client prior to placement would have saved some time and certainly some frustration. Sally was learning the employer's customer accounting system as well as basic computer function and operation of the voice synthesizer all at the same time. It would have been easier for all if she had received some previous training on the computer and voice synthesizer.

In addition, the client's office was initially located near the loading dock area and was moved after she was on the job for three months. The walkway needed to be cleared c weeds for Sally to be able to reach her office without havin to travel through the warehouse area. The employer opene an old entrance to the office, which not only made it easy fo the new employees without sight to get to work, but also provided easy access for all employees in that area.

CURRENT JOB STATUS

Sally continues to work as a telemarketing representative. Sh has accepted more responsibility, calling more customers in th two-week turnaround time, and she has increased the sales fo the company. She has received a raise and a promotion an was honored as employee of the year by the Tucson Mayor' Committee on the Employment of the Handicapped.

Sally is functioning well with the equipment and trainin provided. Her employer has asked the state to provide a braill printer for Sally, which would give her access to updates an changes in the information she utilizes on the job. At this time however, the state is unable to do so, and the employer, wh cannot afford the equipment, is seeking other possible funding sources. The placement specialist is also looking for othe funding sources to purchase the printer, with the idea tha several clients would have access to the equipment.

Three Equipment Proposals for a Dictation Typist

Duane R. Christianson

Sam is 33 years old, and totally blind as a result of retinopathy of prematurity. He has excellent mobility skills and a clear interest in solving practical problems. He graduated from high school and worked for a few years as a road musician for the Western Music Association playing keyboards, saxophone, and bass. He learned IBM Mag A I and II equipment at a technical college in his hometown in a neighboring state, then moved to Illinois to find employment. At the Chicago Lighthouse for the Blind he reviewed Mag I and II and learned to use the IBM Audio Typing Unit. In May 1981, he began work as a dictation typist for an insurance company, using an IBM Selectric typewriter. He had no experience with microcomputers.

JOB MODIFICATION AND EQUIPMENT PROPOSALS

The insurance company subsequently installed computer equipment in their offices and decided that Sam's job should be modified to utilize the new equipment. Because they were not certain exactly what computerized systems Sam could use to do dictation typing (they had at least three computer systems in their office), they asked the Lighthouse to prepare two equipment recommendation proposals based on two separate job modifications. They did not ask for firm assurances that we had tested everything. Shortly after this, they asked us for a definite proposal based on a third job description.

The first recommendation assumed that Sam would be spending most of his time preparing and editing text to be stored on an NBI System 64. We recommended a $4,140 upgrade of the employer's NBI System 64 to let it connect to an IBM PC; a $3,950 IBM PC system with software and hardware to allow it to connect to the NBI System 64; and a $4,550 Professional Vert speech synthesizer. Before submitting this recommendation we made sure we could test the system we had proposed. The total cost of the recommendation was $12,640.

The second proposed job description was for Sam to produce text in electronic form that could be shared by IBM DisplayWriters. We recommended a $3,026 IBM PC, including Hooleon Touchdown Keycaps; a $4,550 Professional Vert speech synthesizer; a $229 IBM DisplayWrite 2 word processing program; and special $1,795 Word Connection diskette-sharing technology from Flagstaff Technologies that allows a PC to share text files in IBM's DCA format with DisplayWriters. In this case, we did less extensive research into how we might test this technology if necessary. The total cost of this proposed system was $9,670.

FINAL PROPOSAL

The third and final job description assumed that Sam would prepare text in inkprint and not need to share any documents electronically. We recommended a stand-alone work station that included a $2,295 IBM PC XT with an initial 256K RAM; two 360K storage disk drives; a $395 AST Six-Pak Plus Multi-Function Card with a clock/calendar, 64K RAM (bringing the system to 320K RAM), and a serial port; a $275 monochrome/parallel card and monochrome monitor; and a $65 copy of PC DOS 2.1.

The employer's home office considered various printers, including the Hewlett-Packard LaserJet, IBM Wheelprinter, and IBM Quietwriter. The final choice was the 25-character-per-second Wheelprinter, which uses a cut-sheet feeder. The printer cost $1,850.

The IBM PC keyboard had caused problems for many blind clients, so we recommended a $21.95 set of Touchdown Keycaps from the Hooleon Company. We also recommended a $48.95 Lock-Lite keyboard status indicator from Lambert Logical Design.

We chose the $349 DisplayWrite 3 (version 1.1) to do word processing. The $500 Freedom 1 program (version 2.04) from

Interface Systems International was recommended to make the system talk through a $395 Votrax Personal Speech System connected to the PC by a specially wired $18 cable. Because computers cannot be trusted to work indefinitely, we recommended a maintenance agreement for on-site service, which IBM quoted at $569 per year. This could not, of course, cover speech output software and hardware.

The final job modification proposal cost $6,781.90. The company deviated from our proposal only in not including clock/calendar as part of the PC.

The Lighthouse assumed responsibility for training Sa on all the equipment and software. Although we would ha been prepared to train him on any of the equipment propose DisplayWrite 3 and Freedom 1 in the third proposal are pa of our standard word processing curriculum. As with any clien we have continued to offer help with troubleshooting.

Environmental Modifications for a Physical Science Technician

Laurel A. Tucker

Job modifications and accommodations for blind and visually impaired persons involve an array of adaptive products and techniques ranging from those of high technical refinement to those of simple yet practical design. Regardless of the design quality and efficiency of these modifications and devices, however, environmental factors in the workplace may hinder a worker from successfully attaining his or her potential productivity and visual efficiency.

Existing environmental conditions often critically affect the visual functioning of an employee who is visually impaired. The case of Mrs. JSG illustrates such a situation, in which enlarging objects and images, controlling the illumination of the work area, and enhancing the contrast of printed materials are important to the successful performance of a variety of job tasks. In her investigation of various possible solutions to her work difficulties, Mrs. JSG has obtained assistance from the handicapped project manager at her place of employment, personnel at state blindness and visual services, and staff at local low vision services.

CLIENT INFORMATION

Mrs. JSG, 28 years of age, is visually impaired as the result of high myopia and retinopathy of prematurity. Distance clinical acuity with prescriptive glasses is 10/600 in the right eye and 10/25 (20/50) in the left eye. She can attain an acuity in the left eye of 10/10 (20/20) utilizing a 4.2X clip-on telescope with her glasses. Although she can spot-read small print (0.8M) at 5 cm, her endurance is limited.

Having previously taken chemical engineering courses at Drexel University, this client is currently majoring in applied textile chemistry at the Philadelphia College of Textiles. She began working in 1983 at the Defense Personnel Support Center's clothing and textile laboratory in Philadelphia.

JOB DESCRIPTION

As a physical science technician in the equipage section of the clothing and textile laboratory, Mrs. JSG inspects the physical properties of items purchased and used by the military. She makes scientific analyses of items (such as feathers and down in parkas and sleeping bags, decorative ribbon, Velcro hooks, shark repellent containers, and boot leather) to determine whether they meet government standards. She must physically manipulate and accurately read scientific measurement and testing devices such as micrometers, scales, and machine gauges.

The primary visual difficulties of this worker are related to the size and viewing distance of materials and equipment, the print size and quality of reading materials, and the reflective glare created by the laboratory lighting. She must be able to distinguish fine details of military materials for visual analyses, make mechanical adjustments on equipment, and read gauges at various distances. Reading technical manuals and blueprints can be tedious. Laboratory conditions such as air control and lighting must be maintained for standardized testing.

This technician must have the versatility to test a variety of materials at different work stations in several rooms. As the materials and testing devices change, she must adapt to new visual demands. Laboratory lighting standards do not allow making changes in the environmental lighting fixtures. Mrs. JSG utilizes both optical and nonoptical devices for increased precision, efficiency, and comfort in job tasks. Her specific adaptive devices do not require restructuring work stations, nor do they interfere with the procedures of other laboratory technicians.

JOB MODIFICATIONS

Mrs. JSG purchased orange clip-on filtering lenses (estimated cost, $30) and colored acetate filters (estimated cost, 50¢) to enhance print contrast and to counteract glare from reflections on work surfaces created by the exposed fluorescent tubes in the overhead fixtures. She has not yet obtained recently prescribed Corning CPF 511 glasses ($200). Early in 1987, she purchased a Keeler 4.2X clip-on telescope ($168), a portable device for spotting and reading with a focusing range of 8 inches to infinity.

The client can accomplish some sample analyses and paperwork at her own desk, where she can adjust magnification, contrast, and lighting. A high-intensity lamp (estimated cost, $10) gives added task lighting as needed. Alligator spring clamps mounted to a metal base ($6.95) keep items steady under magnification and allow her to keep both hands free. For most reading, writing, and magnification inspection tasks at her desk, Mrs. JSG uses a VTEK Voyager XL closed-circui television (CCTV) system (estimated cost, $3,000), which wa purchased by the Defense Personnel Support Center.

CURRENT JOB STATUS

Mrs. JSG is maintaining the precision and accuracy require for her job duties. Co-workers have adjusted to her appearanc when wearing the clip-on telescope. The CCTV system ha helped the laboratory to defend government test results in cour cases successfully. Internal management has supposedl recommended acquisition of additional CCTV systems fo future use by other quality assurance employees at the Defense Personnel Support Center.

Job Adaptations for a Visually Impaired Diesel Mechanic

Billy Mayfield

Larry, a 27-year-old diesel mechanic, had worked at his job for two years when he lost his sight in August 1982 as a result of an accident. He was inflating a truck tire when it exploded. The rim struck him in the face, resulting in enucleation of the right eye and leaving a huge scar on the retina of the left eye. The accident also caused a severe knee injury and the collapse of the paranasal sinuses. Residual vision in the left eye was limited to the lower half of the visual field. Larry's functional vision appears to be approximately 20/400.

At the time of the accident, Larry lived at home with his father, stepmother, and a sister who was in college. He had graduated from high school and completed two years of vocational training as a diesel mechanic. He enjoyed his work as a mechanic. He benefited from strong family support and is an extremely capable and motivated individual.

JOB DESCRIPTION

Approximately seven months after the accident, Larry returned to work at Taylor and Jeans, Inc., the oldest Detroit Diesel Allison distributor in the southeastern region of the country. For the past four years, he has rotated among three positions: dealer-parts sales representative, receiving clerk, and stockperson. His present responsibilities represent a promotion. As dealer-parts sales representative, Larry looks up part numbers kept on microfiche, checks microfiche inventory to see if parts are in stock, and retrieves parts from bins. As receiving clerk, he checks the manifest as parts come in, makes sure that all parts are in each shipment, and records parts on inventory. As stockperson, he places parts in the appropriate bins.

JOB MODIFICATIONS

No attempts were made to modify the job of diesel mechanic that the client was performing before the accident. Because of an excellent work record, the employer was willing to transfer Larry to a job that he could perform with his loss of sight. After spending approximately 2½ months at the Addie McBryde Rehabilitation Center for the Blind, where he learned to use a variety of low vision devices, he was placed in his present position.

To enable Larry to read the inventory and parts numbers, he was provided with a VTEK microfiche viewer. A VTEK Voyager XL allows him to read shipping manifests and computer printouts of the master inventory. He also uses a 7-power hand-held magnifier to read labels on incoming parts and on part bins.

The total cost of the low vision devices provided to this client was approximately $4,500. Workmen's compensation insurance paid for the Voyager XL and microviewer. Mississippi Vocational Rehabilitation for the Blind provided the hand-held magnifiers as well as training in the use of all the low vision devices.

CURRENT JOB STATUS

As a result of the job modifications instituted, the client was able to function successfully in the positions described here. He returned to work with Taylor and Jeans in April 1983 and continues to work for them in these jobs.

The key to success in this case was the employer's willingness to work with the client after his sight loss. The company was open to suggestions, even to the point of placing the client on an entirely different job. One of the client's employers, who worked directly with Larry after his return to work, has commented, "Larry's attitude is his biggest asset. Larry didn't want any special treatment; he wanted the same treatment as other employees."

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Approaches to job modification for people who are blind or visually impaired.

DATE DUE

AMERICAN FOUNDATION FOR THE BLIND
15 WEST 16th STREET
NEW YORK, N.Y. 10011

American Foundation for the Blind
15 West 16th Street, New York, New York 10011